Heat exchanger provided with fixing elements, in particular in a vehicle

The invention relates to a heat exchanger with fixing elements comprising predetermined points of fracture, in particular in a motor vehicle, according to the preamble of patent claim 1.

Such a heat exchanger is known from EP 0 870 638 B1, where the predetermined points of fracture serve in particular the purpose of making it possible for the heat exchanger itself to come away undamaged from the fixing elements in the event of a vehicle accident. By virtue of this, it is only necessary for repair to renew the fixing elements, by virtue of which the repair costs can be reduced considerably in comparison with the case of damage to the heat exchanger when the fixing is not separable. With the type of fixing of the known heat exchanger, a predetermined point of fracture once destroyed cannot be restored when repair is effected. Rather, the area of the heat exchanger originally comprising the predetermined point of fracture has to be replaced with a component to be connected firmly to the heat exchanger. The component to be attached firmly is screwed specially into the heat exchanger.

In a heat exchanger of the generic type, the invention deals with the problem of making it possible to replace a predetermined fracture point mounting of a heat exchanger with an equally effective predetermined fracture point mounting again in as simple a way as possible even after a first fracture of this mounting. In this regard, the parts to be replaced after a preceding predetermined fracture are on the one hand to be connectable as simply as possible to the heat exchanger and on the other hand to make possible simple remounting of the heat exchanger in its supports.

A heat exchanger of the generic type with the characterizing features of patent claim 1 demonstrates a basic solution of this problem.

Advantageous and expedient developments form the subject matter of the subclaims.

The invention is based on the general idea of locating the predetermined points of fracture on the fixing elements of the heat exchanger in areas which can be connected to the heat exchanger by quick-acting connections. In this regard, it is especially advantageous to provide the predetermined points of fracture in such a way that the quick-acting connections already open automatically when a predetermined fracture occurs. When repair is effected, only the areas of the fixing elements of the heat exchanger which are separable or already separated in the quick-acting connections need to be renewed in the solution according to the invention.

In the subclaims, in particular special designs of the quick-acting connection means are indicated, which on the one hand afford firm mounting of the heat exchanger in the supports receiving it and on the other hand, in interaction with a number of quick-acting connections arranged on the heat exchanger, make possible simple remounting when repair is effected. Especially advantageous embodiments in this respect form the subject matter of the last two subclaims.

An advantageous illustrative embodiment is shown in the drawing, in which, in each case in a perspective illustration,

Fig. 1 shows a heat exchanger, illustrated in dot-dash lines, with different quick-acting fixing elements at its upper and lower corners;

Fig. 2 shows an exploded illustration of an upper quick-acting connection, and

Fig. 3 shows an exploded illustration of a lower quick-acting connection.

A heat exchanger 1 indicated in perspective only by dot-dash lines is mounted vertically at the top and at the bottom between an upper support and a lower support 4 and 5 respectively via upper and lower quick-acting connections 2 and 3 respectively.

The heat exchanger can be in particular a cooling module in the front area of a motor vehicle and comprise a water cooler, a condenser and a fan. In the illustrative embodiment, the upper and lower supports 4 and 5 are indicated only symbolically for supporting elements usually present in a motor vehicle in these areas. The inlet and outlet lines for fluids flowing through the heat exchanger (not illustrated in the drawing) are in each case provided at least with flexible areas, so that, when predetermined points of fracture are provided between the heat exchanger 1 and the supports 4 and 5, the heat exchanger 1 itself can be displaced undamaged out of its fixing position when a predetermined fracture occurs. Such undamaged displacement of the heat exchanger is to be possible in the event of a vehicle accident in order that on the one hand no heat exchanger fluid can escape and on the other hand cost-effective repair can be carried out without exchanging the heat exchanger 1.

The upper and lower quick-acting connections 2 and 3 are designed differently.

A lower quick-acting connection 3 is described in greater detail below with reference to the exploded illustration in Fig. 3. This quick-acting connection 3 is designed in the form of a dovetail connection. A tongue part 6 of the quick-acting connection 3 is an inseparable component of the heat exchanger 1. The groove part 7 of the quick-acting connection 3 assigned complementarily to the tongue part 6 can be connected detachably to a bearing 9 within the lower support 5 via a formed-on pin 8.

With respect to a predetermined fracture mounting of the heat exchanger, the groove part 7 of the quick-acting connection 3 is designed as a sacrificial part which functions when a predetermined fracture takes place. In order to be capable of performing this function, at least one of the two webs 10 of the groove part 7 is provided with a predetermined point of fracture 11 designed as a material weakening.

When a predetermined fracture takes place in the area of the lower quick-acting connection, the quick-acting connection bursts open automatically by virtue of the web 11 provided with the predetermined point of fracture breaking off. For repair, only the groove part 7 has to be replaced. The bearing 9 within the lower support 5 is in particular an elastic bearing.

The exploded illustration in Fig. 2 shows the construction of the upper quick-acting connection 2. There, an upper pin 12 is connected firmly and inseparably to the heat exchanger 1. A sleeve 14 provided with a cap 13 is provided as a complementary quick-acting connection means for connection to the upper pin 12. After being guided through an opening within the upper support 4, the sleeve 14 can with the aid of the cap 13 be snapped firmly but detachably into this upper support 4. The sleeve 14 is provided with

slits 15 for creating predetermined points of fracture. An elastic bearing ring 16 is introduced between the quick-acting connection means which engage with one another in the upper quick-acting connection 2, namely the upper pin 12 and the sleeve 14.

When a predetermined fracture takes place in the area of an upper quick-acting connection 2, the sleeve 14, weakened by the slits 15, breaks open, by virtue of which the upper pin 12 is freed. By virtue of this, the heat exchanger 1 can be displaced without damage.

When repair is effected, remounting of a heat exchanger 1 which has been displaced without damage during an accident by the predetermined points of fracture giving way takes place in particular as follows.

In the quick-acting connections 2, 3, the parts 7 and 14, which have been destroyed by the specific predetermined fractures, are replaced.

In a first remounting step, the lower quick-acting connections 3 are renewed by joining the groove and tongue parts 6, 7 together. The heat exchanger 1 is then inserted via the lower pins 8 into the bearings 9 of the lower support 5, pivoting of the heat exchanger 1 being possible by virtue of the elasticity of the bearings 9. In this way, the heat exchanger 1 is pivoted into a position in which renewed sleeves 14 of the upper quick-acting connections 2 can be connected through the upper support 4 to the respective upper pin 12 of the heat exchanger 1. At the same time as the upper quick-acting connections 2 are closed, the sleeves 14 are snapped firmly in the upper support 4 by means of the caps 13 connected to them. After this, the heat exchanger 1 is mounted ready for operation with a renewed predetermined fracture mounting, which allows renewed breaking-open caused by an accident.